



Anesthesia for North American cervids

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With the increasing popularity of game ranching, veterinarians are frequently called upon to treat a variety of exotic species. Many of these animals can be challenging to work with, and chemical restraint is often required. There are many agents that can be used to produce anesthesia in game-farmed deer, but some of these agents are difficult to obtain or difficult to work with. In this article, I will discuss techniques to produce immobilization and anesthesia in game-farmed deer with drugs that should be available in most mixed animal practices.

Sedation

Xylazine can be used quite effectively for sedation. Wapiti require approximately 1 mg/kg body weight (BW) of xylazine, IM, to produce recumbent sedation. White-tailed deer and mule deer usually require 2 to 3 mg/kg BW of xylazine, IM, to produce recumbent sedation. The drug can be administered by hand injection or pole syringe if the animal is in a handling facility, or by remote delivery using a blow pipe or low powered rifle if handling facilities are not available. Once the xylazine has been administered, the animal should be left alone until it assumes a position of lateral recumbency. When the animal is recumbent, it should be cautiously approached and a towel should be placed over its eyes to decrease stimulation; noise should be kept to a minimum. Animals may appear to be very sedate under xylazine sedation, but they can wake up quite suddenly. To decrease the chance of sudden arousal, I prefer to administer 1 mg/kg BW of ketamine into the jugular vein as soon as I approach the animal. I usually administer a "top-up" of ketamine at 10- to 15-min intervals. It is important to allow at least 10 min to elapse following the last dose of ketamine, prior to reversal of the effects of the xylazine. If ketamine is administered close to reversal, rigidity and convulsive activity may be seen. A combination of xylazine at the above doses in wapiti, mule deer, and white-tailed deer, plus azaperone at a dose of 0.1 mg/kg BW, IM, will produce very effective sedation; unfortunately, cyanosis is often encountered if ketamine is administered in addition to the above combination. Side effects of xylazine sedation can include rumenal tympany, regurgitation, decreased thermoregulatory ability, and respiratory and cardiovascular depression. Since xylazine-induced sedation can last

several hours, the effects of the xylazine should be reversed once the procedure has been completed. Yohimbine is very effective in cervids at a dose of 0.1 to 0.2 mg/kg BW. I generally administer 0.1 mg/kg BW, IV, and 0.1 mg/kg BW, IM. Tolazoline is also effective and can be used at a dose of 2 to 4 mg/kg BW. This dose can also be divided half IM and half IV.

Sedation plus local anesthesia

Various local anesthetic techniques may be used in cervids and can be combined with sedative techniques for surgery. Techniques include antler block (1,2), paravertebral or field block for flank analgesia, local infiltration, and IV regional anesthesia (3). The major factor to keep in mind when these techniques are used is the size of the animal and the toxicity of the drug. To avoid toxicity, it is wise to avoid doses of lidocaine in excess of 8 mg/kg BW during infiltration and to use less than 4 mg/kg for IV regional. With 2% lidocaine in a 60 kg deer, this translates to no more than 24 mL with infiltration, and no more than 12 mL of lidocaine, without epinephrine, IV. To increase the volume available for administration, the lidocaine can be diluted with an equal volume of sterile water to produce a 1% solution.

Intravenous anesthesia

Short term anesthesia can be readily accomplished with combinations of xylazine and ketamine. If xylazine and ketamine are administered together, IM, a dose of 2 mg/kg BW of xylazine and 3 to 4 mg/kg BW of ketamine is required in white-tailed and mule deer. In wapiti, the dose of xylazine should be dropped to 1 mg/kg BW. There are 2 major disadvantages with this combination. The 1st disadvantage is that the drug volume is large enough that 2 darts are often required. The 2nd disadvantage is that adequate time must be allowed for the animal to absorb and metabolize the ketamine; one must usually allow 30 to 45 min post ketamine administration before reversing the effects of the xylazine.

A better approach is to administer, IM, a sedative dose of xylazine (2 to 3 mg/kg BW in white-tailed and mule deer, 1 mg/kg BW in wapiti). Once the animal becomes recumbent, a dose of 1 to 2 mg/kg BW of ketamine is administered, IV. This will produce approximately 15 min of anesthesia. Anesthesia may be prolonged by the administration of additional boluses of ketamine (0.5 to 1 mg/kg BW) as the depth of anesthesia decreases, usually at 10- to 15-min intervals. Using this technique, anesthesia can be prolonged

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for up to 30 min, and the effects of the xylazine may be reversed 10 min following the last dose of ketamine. With this technique, animals tend to maintain their airway protective reflexes, somewhat; if regurgitation does occur, the head should be lowered, the pharynx should be suctioned if possible, and the animal should be intubated. The major complication that can occur with this technique is hypoxemia. This becomes more of a problem if anesthesia is maintained for longer than 15 min. To limit hypoxemia, the animal should be maintained in sternal recumbency, if possible. Lateral recumbency is preferable to dorsal recumbency, and if procedures are likely to take longer than 15 min, supplemental oxygen is recommended at a flow of 100 mL/kg BW/min by nasal or tracheal administration. Catheterization of the jugular is simple in cervids and will greatly facilitate top-up doses of anesthetic drugs and also provide a route for the administration of emergency drugs, if required.

I have combined guaifenesin with bolus ketamine for maintenance. Extra care must be taken as these animals appear to be particularly sensitive to toxic side effects. Signs of guaifenesin toxicity include extensor rigidity or opisthotonus. If these signs are noted, administration of the guaifenesin should be discontinued. The animal should be monitored closely for respiratory or cardiac complications. Anesthesia can still be maintained with ketamine, if necessary.

Inhalational anesthesia

For prolonged or very invasive procedures, inhalational anesthesia is recommended. Either halothane or isoflurane can be used. Animals weighing up to 150 kg can be maintained on a small animal circle system. A 3- to 6-L rebreathing bag should be used with fresh gas flows of 10 to 20 mL/kg BW/min. Cervids premedicated with xylazine can usually be maintained on approximately 1% halothane or 1.3% isoflurane.

Induction of adult cervids can be achieved with xylazine sedation, followed by IV ketamine at a dose of 2 to 3 mg/kg BW, using the techniques described above. Fawns are usually very easy to handle. Xylazine should be avoided in cervids aged less than 3 mo, as neonates are very dependent on heart rate for cardiac output, and bradycardia is not well tolerated. Fawns can be induced with IV diazepam, 0.2 mg/kg BW, combined with ketamine, 2 to 3 mg/kg BW. Cervids maintained on volatile anesthetics must be intubated, as airway protective reflexes are absent and regurgitation and aspiration are likely to occur. Intubation is difficult in cervids. The best technique is to maintain the animal in sternal recumbency with the head and neck extended. A laryngoscope with a long flat blade and an endotracheal tube, straightened with a stylet, greatly facilitate intubation. The epiglottis is long and mobile in cervids. The flat blade of the laryngoscope should be placed on the dorsum of the epiglottis, depressing it ventrally. The opening to the glottis can then be visualized and intubation can proceed. Animals induced with xylazine and ketamine may swallow or close the glottic opening during intubation. If difficulties are encountered, the depth of anesthesia may be increased with an additional dose of ketamine (1 to 2 mg/kg BW). If difficul-

ties are still encountered, a low dose of guaifenesin will facilitate intubation.

Problems often encountered during general anesthesia include hypoventilation, especially if the animal is maintained in dorsal recumbency. I often find that intermittent positive pressure ventilation is required, especially in dorsally recumbent animals. Cervids usually tend to maintain a relatively high blood pressure; hypotension may be encountered, especially if rumenal tympany is present. Rumenal tympany can occur under volatile anesthesia. The frequency of rumenal tympany can be decreased if food is withheld for 24 to 36 h prior to anesthesia. Water should be withheld for 12 h prior to anesthesia, if possible. Rumenal tympany can occasionally be resolved by passage of a stomach tube. If this does not work, the anesthesia may have to be terminated or emergency rumenal trocharization performed. The respiratory and hemodynamic compromise produced by rumenal tympany in an anesthetized animal can be severe. Passive regurgitation can occur, and it is important to inflate the cuff on the endotracheal tube to ensure an adequate seal of the airway. The animal should be extubated when the swallowing reflex occurs and the cuff should be removed with the cuff partially inflated, especially if passive regurgitation has occurred. Animals that have had xylazine premedication should receive yohimbine, to reverse the effects of the xylazine, at a dose of 0.1 to 0.2 mg/kg BW. I often divide the dose, giving half IM and half IV. Postoperative analgesia can be achieved with 0.025 to 0.05 mg/kg BW of butorphanol.

Monitoring anesthesia

Blood pressure can be measured in cervids by direct or indirect techniques. A Doppler and cuff or an oscillometric cuff may be used on the distal part of the limb. An electrocardiograph may be used with a 4-lead axis. This will provide information regarding heart rate and rhythm. The pulse oximeter is probably the most useful piece of equipment on the market for monitoring anesthesia, especially in the field. Several small hand-held models are available; the probe can be applied to the tongue and hemoglobin saturation can be measured. Normal saturation ranges from 95% to 97% on room air. If saturation falls below 85%, hypoxemia is present and supplemental oxygen and possibly ventilation are required.

In conclusion, sedation and anesthesia of deer can be a challenge. If care is taken to avoid excitement, xylazine can be used quite effectively for sedation and premedication prior to general anesthesia. Many procedures can be performed with sedation plus local anesthesia, or with IV anesthesia. Extensive procedures often require volatile anesthesia. Deer are prone to the same complications as domestic ruminants, and steps should be taken to prevent hypoxemia, rumenal tympany, and regurgitation.

References

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